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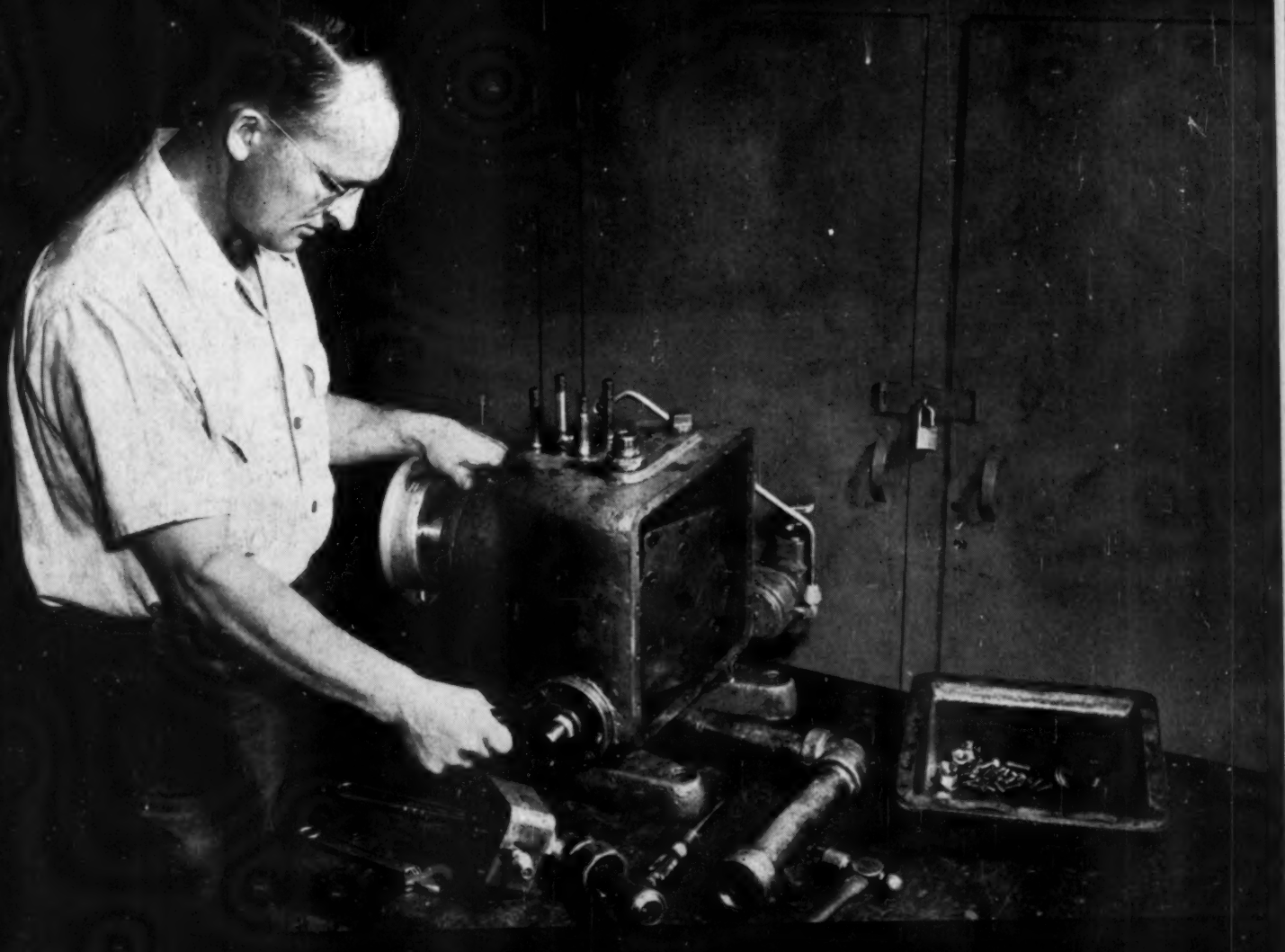

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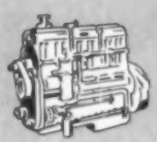

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FRONT COVER: A view in the pump rebuilding shop at The Hoover Company, North Canton, Ohio. This function, while not common, is being done by an increasing number of hydraulic equipment users. See story, page 10.

—Newman-Schmidt Photo

CONTENTS

Editorial—Let's Be Selfish 8
By Irving B. Hexter

Here's How We Plan for Better Maintenance 10
By K. W. Zintz

Electronics Need Not Scare You, (Part 2) 13
By Richard C. Roetger

The New Hydraulic Standards for Industrial Equipment 16

The Correct Use of "O"-Rings on Valve Seats 19
By Tommy J. McCuistion

DEPARTMENTS

MAINTENANCE SECTION
Hydraulic Maintenance of Machine Tools, HM-2 21

NEW PRODUCTS 24

USEFUL LITERATURE 27

LETTERS TO THE EDITOR 28

APPLIED HYDRAULICS DIGEST 29

POSTSCRIPTS OF INDUSTRY 31

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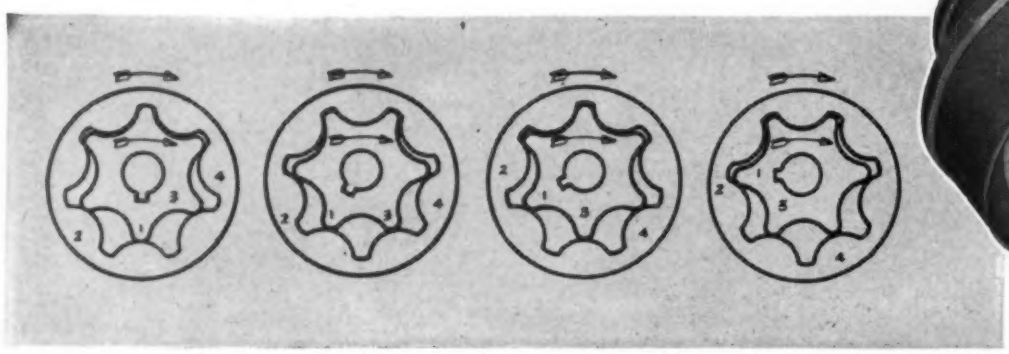

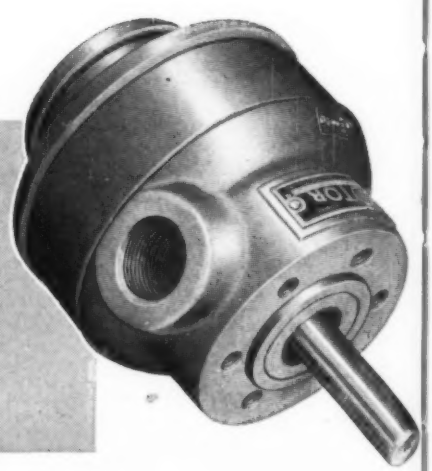

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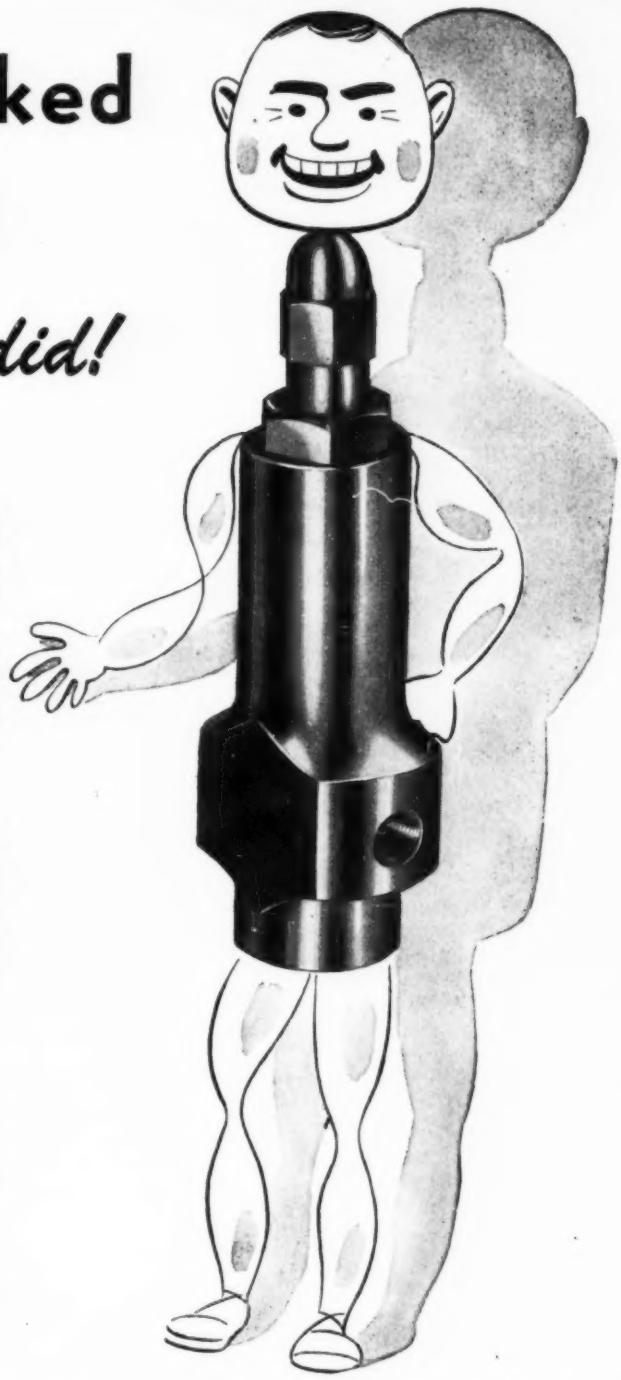

THE PROBLEM:

Customer manufactured his product on mechanical machines. A bigger size was needed, but to build this larger size mechanical machines would have to be bigger—in fact, too big to be practical.

Our engineers were called in to explore the possibilities of hydraulic actuation so that the larger product could be made on a machine small enough to be practical.

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LET'S BE SELFISH

REGARDLESS of what your politics are, you will probably join with the rest of America and agree that Mr. Dewey's surprise defeat was due to overconfidence. His advisers, the polls of public opinion, the newspapers and all the rest of the experts gave Mr. Dewey the election before he won it. He was lulled into complacence by these false prophets and lost the presidency. He took too much for granted.

As a people, we take too much for granted the blessings of our country. It should scare the pants off us when Communists can take into their camp a man who should be one of our nation's leaders, or when Communists can actually place their members in high governmental places, or when Communists can get some of our government officials to carry on their nefarious work for them. It is time for us to wake up and look around.

It is time that we become suspicious of the organizations with the high-sounding patriotic name. We are so childish we think that any organization with a fine name really means to live up to it. We are not used to the man who offers us the millenium. We think he can actually deliver it to us. Let's be suspicious. Let's be selfish. Let's not be taken in by honeyed words.

What do these people offer us? Freedom. We have more freedom than their beloved Russia ever knew about in its whole history. They know only the police state. They don't even begin to understand our kind of freedom, which arises from the dignity of the individual. They don't understand the kind of freedom which permits a man to work where he pleases and quit that place if he pleases.

They don't understand what it means for us to be able to say and do anything that pops into our heads, singly or collectively. They don't understand what it is to be able to worship as we choose, to live where and as we want, to go and come as we want with no interference from the State.

They want to give US freedom? Bunk. We could give them plenty of ours and still have some left over.

What else do these people offer us? Democracy. It's sand in your eyes. They don't know what Democracy is. They know the police state. They know the one-party ballot. Vote their way—or off comes your head. They never saw a Mr. Truman and Mr. Dewey run for our highest office, have only a couple of million votes separate them, and then see this country unite behind the winner to make America function just as though their very own candidate had won. They don't understand this.

They say we are weak and decadent. They don't know that our strength comes from our people. Their strength comes from a government centered in the hands of a few. Ours comes from the 150 millions of people who ARE America.

These are things we must treat selfishly. Let's not lose our birthrights. Let's keep these things. Let's not allow anyone to take them away. Let's guard them as we would our most valuable possession, because that's what they are.

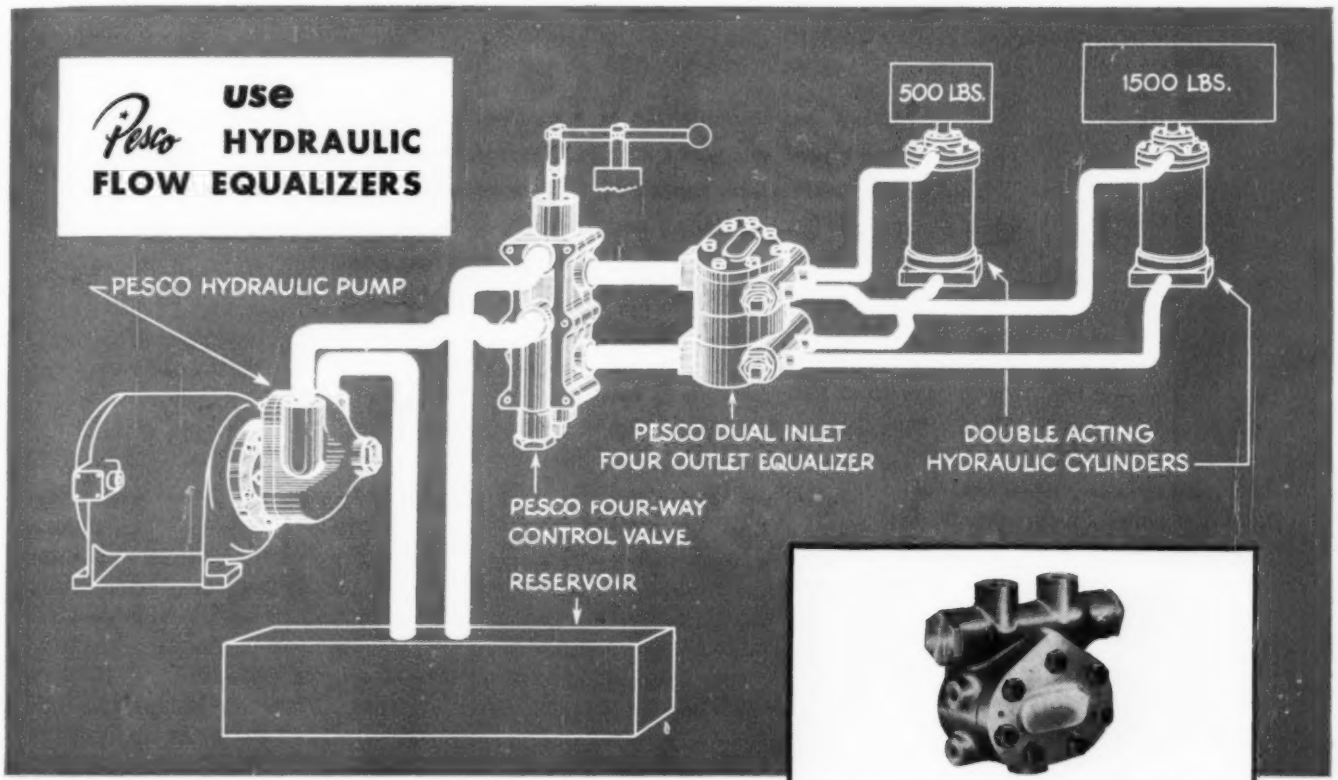
Let's be selfish. Without these rights to freedom, our families, our work, our money, our jobs, our houses and all our possessions amount to nothing. With them, we Americans are the blessed people of the earth.

Irving B. Hexter

Publisher

For handling unequal loads

...SMOOTHLY...SAFELY...ACCURATELY



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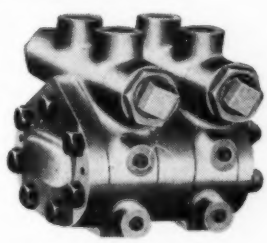
Equalizer with single inlet and two outlets . . . controls stroke in one direction for two single-acting cylinders.



Equalizer with two inlets and four outlets . . . controls the flow to two double-acting cylinders. In another version this model can be furnished with a single inlet and four outlets for controlling the flow to four single-acting cylinders.

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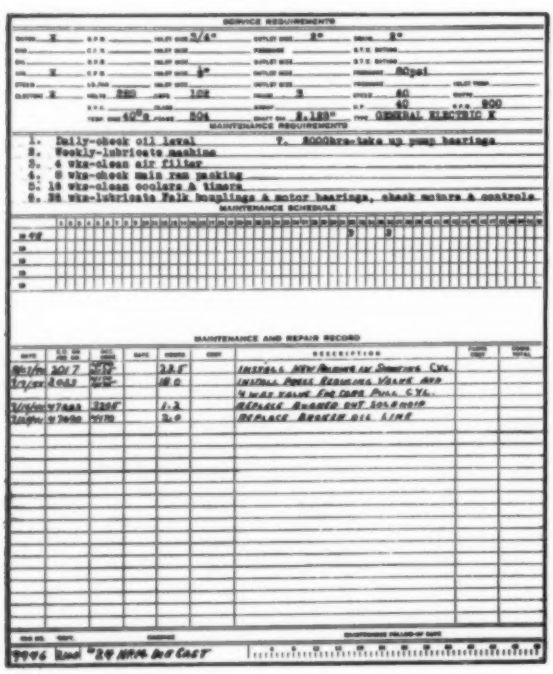
HERE'S HOW WE PLAN FOR BETTER MAINTENANCE

The factors in the building of a hydraulic maintenance department in a plant internationally known for its efficient production methods. A sound program has been built by improving accessibility of hydraulic elements, keeping complete operating and maintenance records, by central station handling and cleaning of oil and by integrated job training.

By K. W. ZINTZ
Hydraulic Machine Repair Department
The Hoover Company
North Canton, Ohio

IN SETTING UP A PRACTICAL, efficient plan for hydraulic maintenance in a plant with both die casting and plastic molding departments, much more than a systematic oil checking and lubricating routine was involved. In some cases, particularly in the die casting department, such a plan included the rearrangement of pumps, valves and distribution lines for convenience and ease of servicing. In others, as in the plastic molding department, individual machine reservoirs were hooked up to a central filtration and purification system to improve control over the condition of the oil. An added activity, still somewhat uncommon, is the pump rebuilding shop. This shop is an important part of the maintenance program in this plant.

The first consideration, of course, is to keep the production equipment in good working order. With various types of die casting machines and plastic molding machines, operating under a range of loads, it was


SERVICE REQUIREMENTS

MAINTENANCE REQUIREMENTS

1. Daily-check oil level
2. Weekly-lubricate machine
3. 4 Wks-clean air filter
4. 6 Wks-check main ram packing
5. 16 Wks-clean coolers & timers
6. 32 Wks-lubricate Falk couplings & motor bearings, check motors & controls
7. 8000hrs-take up pump bearings

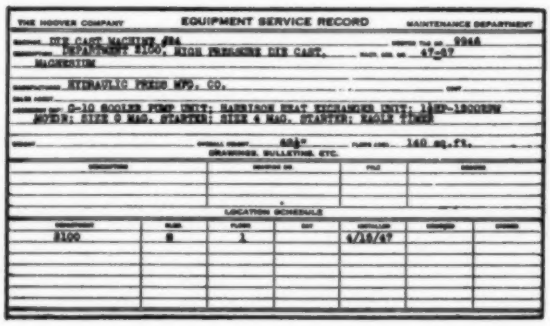
MAINTENANCE SCHEDULE

MAINTENANCE AND REPAIR RECORD

DATE	DESCRIPTION
6/1/44	INSTALL NEW PACKING ON DIRECTING CYL.
7/1/44	INSTALL PRESS REDUCING VALVE AND
	4 WAY VALVE FOR CORE PULL CYL.
7/10/44	REPLACE BURNED OUT SOLENOID
7/20/44	REPLACE BROKEN OIL LINE

9946 Used "24 MFM. DIE CAST"

Fig. 1. Both sides of an actual individual machine record card. A complete history of maintenance is kept in every case. Such a record is a key to efficient trouble-shooting, parts replacement and other service attention.


THE HOOVER COMPANY — EQUIPMENT SERVICE RECORD — MAINTENANCE DEPARTMENT

DIE CAST MACHINE #84 — 9946

DEPARTMENT 3100, HIGH PRESSURE DIE CAST. — 47-47

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DESCRIPTION	REVISION NO.	FILE	REMARKS

LOCATION SCHEDULE

DEPARTMENT	BAY	FLOOR	SET	INSTALLED	CHANGED	CHANGED
3100	B	1		4/15/44		

found that one of the most satisfactory approaches to efficient maintenance was to institute an individual record for each machine. Such a record was evolved (Figure 1), with space for entering such information as the major facts for each machine — the manufacturer's specifications, installation and operation history, including data on types of jobs done, repairs, parts replacement and a complete maintenance record.

It will be noted that there is a place on the maintenance and repair record side of the card for an accumulated cost record. This is a valuable index in determining when an individual machine should be replaced.

The individual card record has been a logical development of sound practices in maintenance and has had several important advantages. First, it has been a convenience in production scheduling, apart from maintenance proper. It has been an index of the efficiency of preventive maintenance. The weekly, monthly and other regular inspections and tests have become routine. Actual maintenance time per machine has been decreased. Replacement of parts or rebuilding can be anticipated in many cases and downtime often can be fitted into changeovers in production runs. The use of the card record as a guide to trouble-shooting has enabled maintenance men to locate difficulties more quickly and accurately. The confidence this gives the man who does the trouble-shooting under stress is an intangible but important factor.

Improving Accessibility

Accessibility of pumps, valves, controls and distribution piping is important in any maintenance planning. It was very easy to neglect a pump or an oil reservoir simply because it involved time and effort to get to it. In our case, a number of machines in our die casting department were designed with all or most of the hydraulic elements within the main machine housing. While the compactness of design is often desirable, it did complicate many otherwise routine maintenance as well as trouble-shooting jobs. For example, an oil leak might require that one or more "layers" of parts or elements be removed to reach the source of trouble. The accident and fire hazards, the loss in operating pressures, the cost of the oil lost and the loss of personal efficiency due to bad housekeeping combined to reduce production and increase costs.

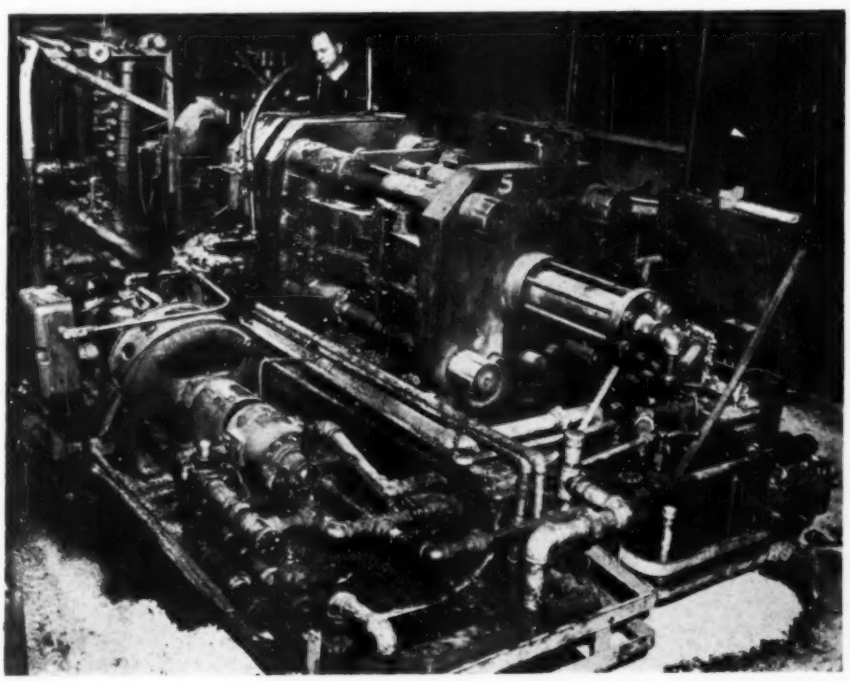
The compensator on the piston pump on several of our die casting machines was originally installed between the machine and the pump and close to the die area. In addition to making any service work unnecessarily difficult, the position next the die area meant that the compensator often became covered with metal. The accessibility problem and the splash metal difficulty were eliminated by reversing the direction of the pump rotation and installing the compensator on the other side of the pump away from the machine.

Another accessibility problem was encountered with the core pull valve. Originally, this was mounted under the machine. We have several die casters of this type. It was necessary to lift the entire machine to get to the valve for service. The core pull valve was moved to a convenient position at the rear of the machine and connected by hose. (Figure 2).

As individual die casting machines completed runs or were down for other reasons, reconversions were made. At the present time the last die casting machine is being rebuilt in the program. The entire hydraulic element accessibility program is expected to be completed without increasing the normally expected downtime.

As the die casting machines went back into regular production, most of the troubles that had been objectionable, had disappeared. Oil leakage was materially reduced. With hydraulic elements more accessible, there was no excuse for neglecting preventive maintenance; it is possible to accomplish service jobs in less time.

Fig. 2. A rear view of a die casting machine after repositioning of hydraulic elements for improved accessibility. The core pull valve (center) is seen with its flexible hose connections. Most joints were welded, greatly reducing the leakage problem.



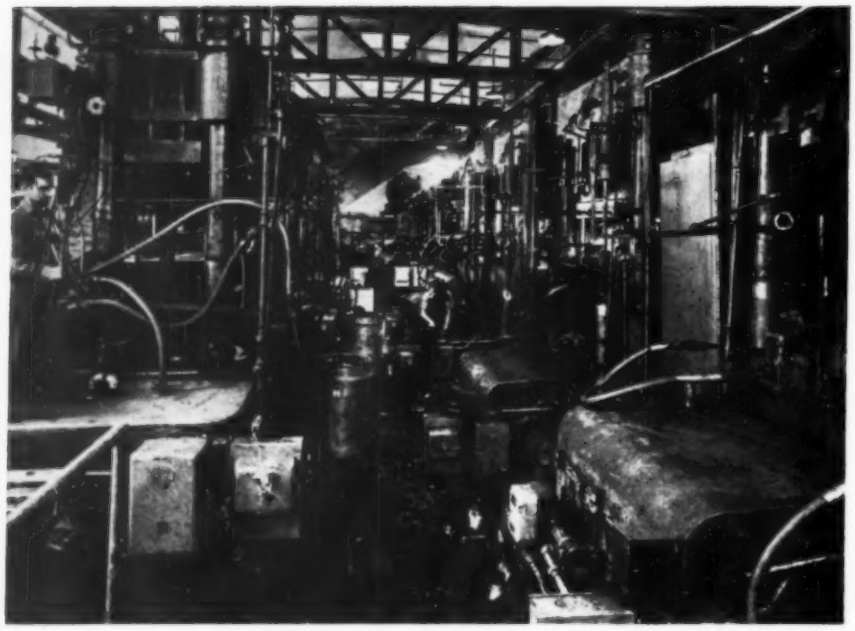


Fig. 3. The "alley" of a double bank of molding machines. The dirty oil storage tank is under the press area; oil is pumped from individual machine reservoirs and returned properly conditioned.

The Dirty Oil Problem

The plastic molding department presented a somewhat different problem. Dirty oil was the big problem. Fortunately, the molding machines are installed in rows, back to back. With the number of sizes and types of machines made by several different manufacturers, the variation in the location of functioning hydraulic elements and the size and position of oil reservoirs made the oil servicing problem a formidable one.

Our experience has been that hydraulic oil reservoirs should have a capacity of five times the pump capacity. It is generally agreed that a reservoir capacity of twice the pump capacity is an absolute minimum. With variations in reservoir capacities on the molding presses and a range of work loads, the effort to keep the oil properly conditioned and at correct operating levels was considerable.

As mentioned before, the molding machines are installed in straight line banks in the "Bakelite" department as we call it. It was found practical to change over to a central station oil changing and purifying system. We installed a 2500 gallon underground tank under the press room, a steam tank of 2000 gallons capacity, a self-contained oil purifying unit and a 1000 gallon overhead clean oil storage tank. Pumps on all tanks move the oil as needed through the system.

Oil is pumped from individual machine reservoirs into the underground oil storage tank. From this tank the dirty oil is pumped to the steam tank where the oil is heated and held at a temperature of 180° F for 24 to 36 hours. This treatment takes the water out of the oil and precipitates out the heavier solids. From the steam tank, the partially cleaned oil is pumped through a separate self-contained purifier unit which completes the cleaning operation. From the purifier unit the clean oil is pumped to the overhead storage tank.

Oil on all machines is changed weekly. This frequency of oil change eliminates the necessity of reservoir cleaning and very greatly reduces the service cleaning on valves and pumps.

A total of eleven men make up the hydraulic working and supervisory force in this plant. Of these, five are trained to rebuild pumps. This company was one of the first to operate such a shop in this territory. A wide variety of pumps, hydraulic and others, are operated in the plant. The pump shop is equipped to service, repair or completely rebuild any of the pumps used throughout the plant. The practical advantages of this service have been to materially reduce downtime due to pump failures and to improve the efficiency of both preventive maintenance and trouble-shooting procedures.

Training of new or less experienced men in the hydraulic machine repair department is carefully graduated to assure a supply of adequate skills. When

(Continued on page 20)

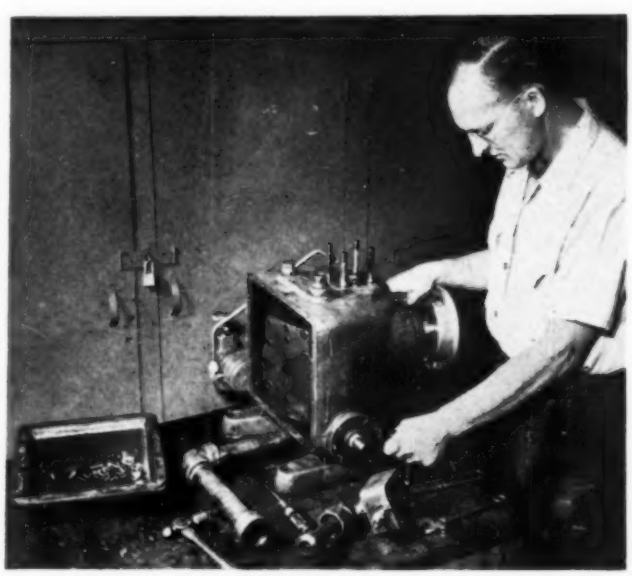


Fig. 4. A pump undergoing an overhaul in the rebuilding shop. Every pump in the plant can be completely serviced in this shop.

Part II of a Series on Electronic Fundamentals

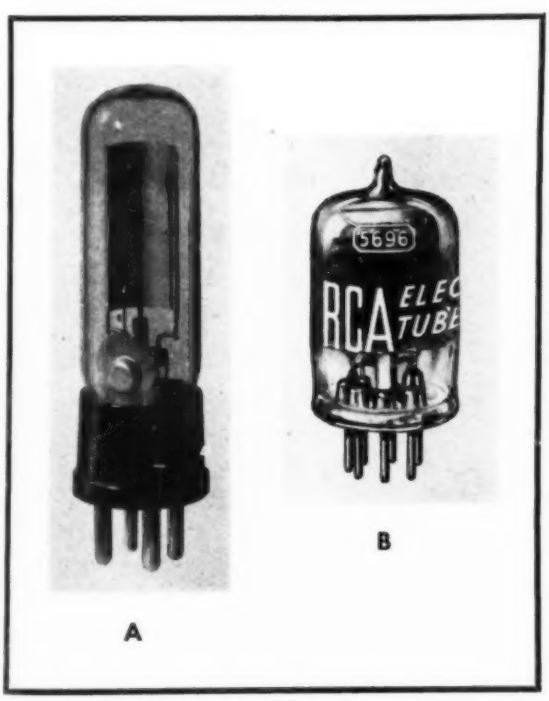
ELECTRONICS NEED NOT SCARE YOU

By RICHARD C. ROETGER
Electronics Consultant

THE FIRST ARTICLE of this series covered generalities pertinent to electronic control circuits. This article describes the operation of a photoelectric relay supplied by a single phase alternating current line. It appears that this device is well suited to the beginning of a discussion of specific units since it involves a study of the phototube and the thyratron, both of which are widely used in control equipment. The ground work so provided will facilitate the understanding of more complex motor control and regulator circuits.

Manufacturers of electric equipment usually employ one of several types of wiring diagrams in their literature. These diagrams generally represent components more or less pictorially and illustrate cabling of the connecting wires. This practice is excellent from the production and maintenance standpoints, but wiring diagrams are not convenient for circuit study. Consequently, schematic diagrams are used; Figure 1 shows conventional symbols which furnish the key to readibility.

We have previously* defined a phototube as one which contains a light sensitive cathode. This tube is essentially a pliotron in which the control grid has been replaced by a sensitivity to light. As we have seen, phototubes do not generate electricity, but, like pliotrons, act as flow control valves, the anode current being controlled by the intensity of light striking the cathode.



A. A typical phototube. *Photo, courtesy, Apparatus Department, General Electric Co.*

B. A miniature thyratron of the gas-tetrode type, designed particularly for relay applications. *Photo, courtesy, Tube Department, Radio Corporation of America.*

The Phototube

There are two basic types of phototubes—gas-filled and vacuum. Gas-filled tubes are more sensitive, but the vacuum types are more rugged and stable; both are used in relay service. The two types are each subdivided into at least three classes indicative of the wavelength (color) of light to which they are most sensitive. For example, both gas and vacuum phototubes are available with peak sensitivities in the red, blue or ultra-violet part of the spectrum.

Probably the easiest way to understand phototube sensitivity is to regard the tube as a current valve through which the flow is a function of the head (anode potential) and the port opening (amount of light strik-

*pp 8, 14 September issue.

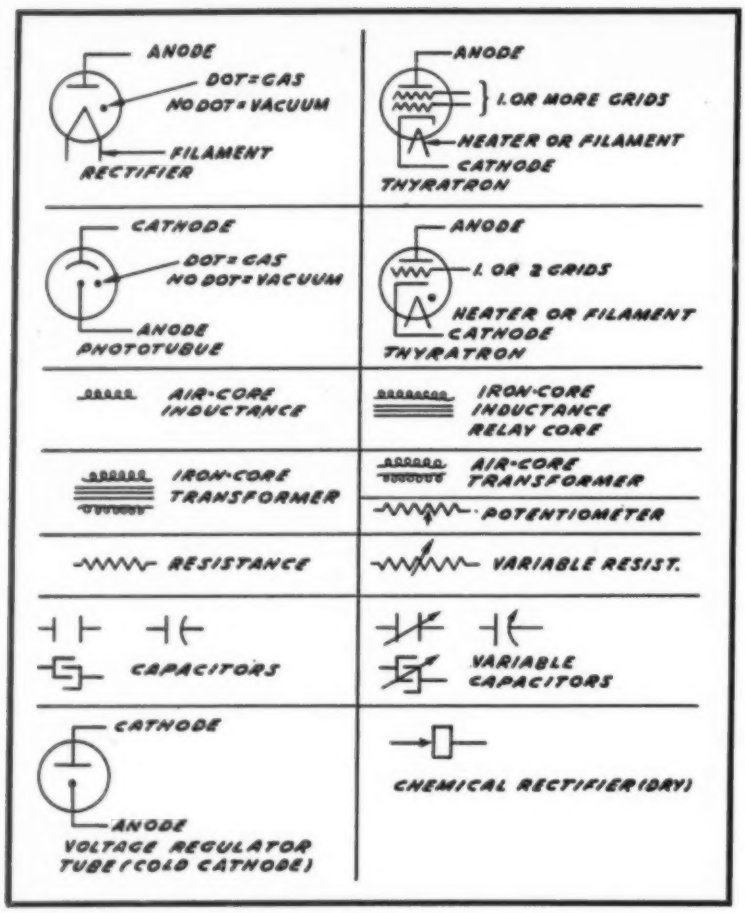


Fig. 1. Conventional symbols are universally used and understood in the electrical industry.

ing the cathode). A further factor is the amount of constriction at the outlet (load resistance).

The curves, Figure 2, illustrate this electrically and is representative of average phototubes. Such characteristic curves are, of course, applicable only when the phototube is subjected to light of the color for which it is designed.

Interpreting the curves is relatively simple. They are a graphical way of stating that with a given voltage applied to the anode and a fixed load resistance in the phototube circuit, a certain amount of light striking the tube will result in a definite current flow in the circuit. In determining the anode current change for a given change in light flux, the load line, not the ordinate, is followed. The load line is drawn from the anode voltage point to the anode current point found by dividing the anode voltage by the load resistance.

It must be remembered that phototubes are unidirectional devices, i.e., they function as check valves that conduct from anode to cathode only; thus the anode must be positive if conduction is to occur.

Anode potential on gas phototubes is limited to about ninety volts, while vacuum types may be operated at as much as 500 volts.

The Thyratron

Like the phototube, the thyratron is a "one-way" valve the flow through which, in this case, is controlled by the voltage on the grid rather than the illumination on the cathode. The anode must be positive if conduction is to occur. Unlike the phototube in which the light maintains control over the anode current at all times, the grid of the thyratron loses control of the anode current once conduction has started. Conduction then continues until the anode voltage drops below a critical value. Thus, when the thyratron is supplied with low frequency (below approximately 600 cycles per second) alternating current, the grid regains control during the half cycles when the anode is negative. This feature plus the large current handling ability for its physical size, makes the thyratron well suited to electric relays. The thyratrons used in this service approximate home radio receiver tubes in size and shape.

The anode voltage-grid voltage relations typical of a thyratron are shown by the curve in Figure 3. This is a graphical way of stating that at a given anode voltage conduction will not take place if the grid voltage

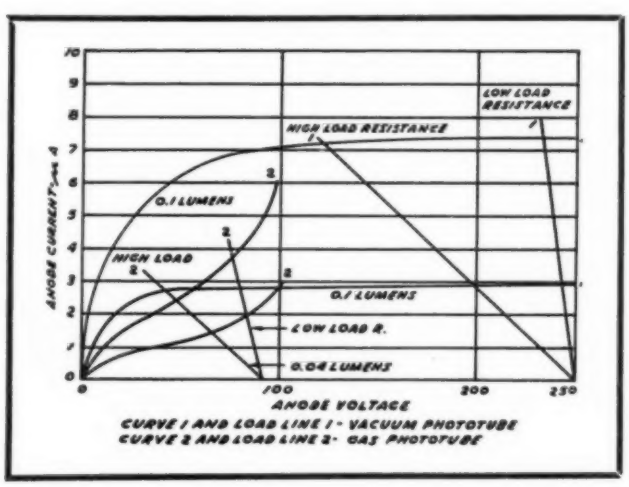


Fig. 2. Phototube characteristics. The curves and load lines for average gas and vacuum phototubes are shown.

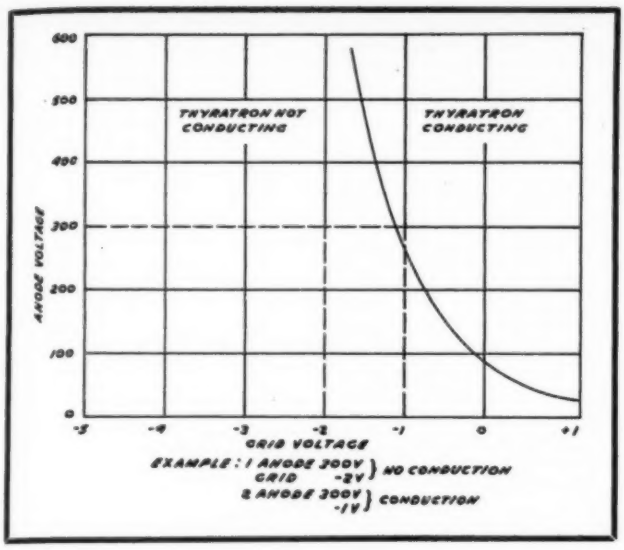


Fig. 3. Thyratron characteristics. The relation of anode voltage to grid voltage determines whether conduction will take place.

is sufficiently negative. Anode current is governed mainly by anode voltage and accompanying circuit resistance. There are also thyratrons in which the grid must become positive before conduction begins. These are advantageous in that failure of the grid supply voltage cannot result in firing (conduction) of the tube.

Still another kind of thyratron is the screen grid or tetrode type. By supplying the proper voltage to the second (screen grid) the curve, Figure 3, can be made to shift to the left or right, thus providing for additional control circuit flexibility.

The small thyratrons used for relay service have a maximum anode current rating around 100 milliamperes (0.1 amp); power supply thyratrons with anode ratings as high as twelve amperes are common.

Direct-Acting Relay Circuit

Figure 4 shows a photoelectric relay circuit designed for operation from the alternating current line. It has been termed "direct-acting" here to indicate that an increase in the amount of light striking the phototube causes the normally open contacts to close. Such designation is by no means standard in the industry.

In analyzing the circuit, it is best to start at the ac input. The resistor network comprising R_1, R_2 and potentiometer R_3 serves two purposes. First, it drops the voltage applied to the phototube anode to a value within the design limits, and second, it provides a means of placing the thyratron grid at a negative potential with respect to its cathode.

Referring to Figure 4, if the supply voltage is 117 volts ac, R_1 will have a value in the vicinity of 10000 ohms for a gas phototube; it may be zero in the case of a vacuum phototube.

Resistor R_4 is the phototube load and the 1R drop across this resistance represents the useful "work" done by the phototube. As phototube currents are in the order of a few microamperes, the load resistance in relay service may be anywhere between one and one hundred megohms, depending upon the available

(Continued on page 20)

Fig. 4. A simple direct-acting relay circuit. The phototube is the actuating member, the thyratron the control member. The resistor network R_1, R_2 and R_3 provides a negative potential for the thyratron grid.

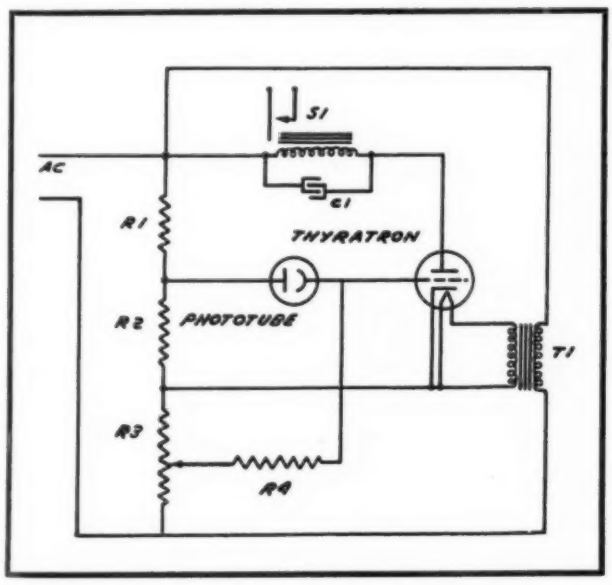
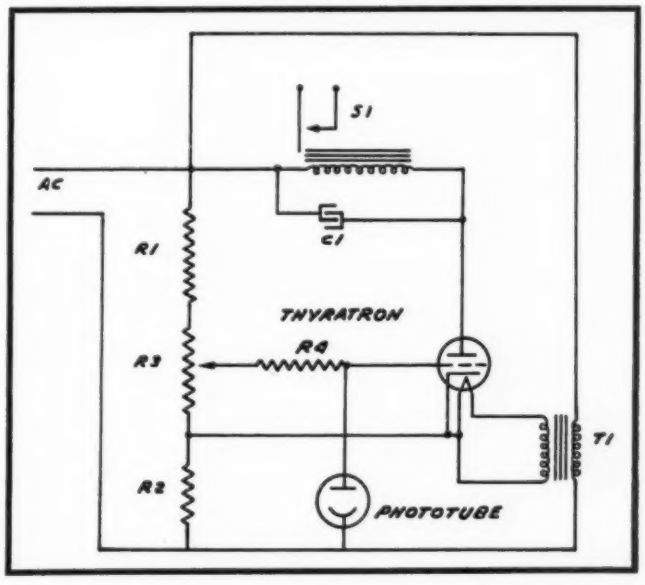


Fig. 5. Inverse acting relay circuit. The arrangement of resistors makes the thyratron grid more positive. The potentiometer, R_3, which controls the point at which the thyratron conducts, is adjusted so that contacts close when the illumination falls below a definite value.



The New
HYDRAULIC STANDARDS

THE TENTATIVE HYDRAULIC Standards for Industrial Equipment were made public on October 21 at the National Conference on Industrial Hydraulics at Chicago. These hydraulic standards were compiled by the Joint Industry Conference consisting of the Automotive Joint Industry Conference, Hydraulic Equipment Manufacturers, Hydraulic Press Manufacturers, National Machine Tool Builders' Association, Resistance Welder Manufacturers Association and the Tubing and Fitting Manufacturers.

The Standards, or "J.I.C." as committee members designate them, were the result of 15 months of effort and over 20 general committee meetings by interested groups. The initial work was undertaken by the Production Engineering Section, Manufacturing Staff, General Motors Corporation as an attempt to clarify standards for the machine tools and other production machines with hydraulic actuation and control bought and used by this Corporation.

However, it was soon apparent that other automotive manufacturers had identical interests and a number of other motor car and truck manufacturers were invited to sit in on the discussions. Specialists in various phases of hydraulic equipment were consulted and as the tentative standards took shape, representatives from the groups listed above took an active part in the deliberations.

The tentative J.I.C., since it is a first effort, is largely general and an effort has been made to keep "specifications" on a recommended or rather liberal engineering limits basis. The J.I.C. does represent the first industry-wide effort to set up hydraulic standards, and the men whose work went into it are to be complimented on the beginning of a good job. Aside from the work of the A-6 Committee of the SAE on Aircraft Hydraulics and Pneumatic Equipment, the J.I.C. is a pioneer effort.

Following a general introductory section (HO), which defines the purpose of the standards and gives suggestions on the responsibility of both supplier and purchaser, there are sections on: diagrams, with suggested symbols (H1); hydraulic controls and control circuits (H2); pumps (H3); piping, fittings and fluid passages (H4); oil reservoirs and heat exchangers (H5); valves, accessories and devices (H6) and safety (H7).

The foreword defines the range of equipment referred to as all machine tools by the classification accepted by the NMTBA and all other types of industrial equipment not generally classified as machine tools, but which are hydraulically actuated.

A glossary of terms used in the hydraulic specifications is included. It is expected that this glossary will be coordinated with a similar project nearing completion by a Sub-Committee on Nomenclature of the SAE A-6 Committee.

Diagrams and Suggested Symbols

The recommendations on diagrams and suggested symbols feature "symbolic" diagrams or line drawings with all hydraulic elements represented by approved standard symbols and schematic diagrams which represent the functional construction of all hydraulic elements and show and describe the flow paths for each phase of each complete cycle. The data which should appear on such diagrams has been rather well agreed upon. However, on the symbols themselves, there is still some disagreement, largely because of the widely varying practices in various companies and in different parts of the country. The Committee left the door open by asking for further suggestions on symbols.

Hydraulic Controls

The third section, H2, on hydraulic controls, defines such controls and outlines the standards of protection to be provided, gives general design suggestions on the design and construction of circuits, with particular attention to position and safety stops and the mounting of controls. For example, section H2.6.2 specifies that "all hydraulic controls shall be mounted two feet or more above the bottom of the equipment, providing such mounting will not impair the proper functioning of the circuit. This paragraph is written as a guide for all new machinery and equipment with the understanding that any deviation will be in accordance with Paragraph HO.2". Paragraph HO.2 states that any exceptions to these standards will be as agreed between supplier and purchaser.

Pumps

The next section, H3 covers recommendations on pumps. The first recommendation is that pumps shall be mounted where they are readily accessible for maintenance and are adequately protected from damage (H3.3.1). The same sec-

tion recommends that on new designs pumps shall not be mounted inside reservoirs. Other recommendations include the protection of pump compartments against dirt and moisture, alignment of direct connected pumps, provision for adequate capacity coupling, mounting bases and seals. It is also recommended that pump name plates carry: (a) manufacturer's name and address; (b) manufacturer's identifying part number; (c) manufacturer's serial number, if any, and that it be attached in a position readily visible or that a duplicate plate be provided where it would be readily seen. It is also recommended that the direction of rotation of each pump be clearly marked on the pump in a position that is readily seen.

It is also recommended that a data sheet or catalog be provided with full information on speed limits, pressure range, delivery, horse-power required and viscosity range.

Piping, Fittings and Fluid Passages

The section on piping, fittings and fluid passages is somewhat more specific than some other sections. By piping all pipe, tubing, hose and fittings are meant. Passages include all fluid conductors other than piping. It is recommended that, when requested by purchaser, that a piping layout or photograph be furnished; that cross sectional area of piping for flow capacity be sufficient on the suction side to prevent cavitation or starvation and on the discharge side to prevent undue temperature rise or turbulence. A safety factor of eight times the normal working pressure was suggested for pipe strength. Solderless piping connections were specified. The performance standard for any type of fitting was set as the equal or better than the requirements of AN-F 47.

Flared type fittings, when used, shall be in accord with Army-Navy Design 10061; the construction of the tube end shall conform to Joint Army-Navy Specification AN-F 366 for minimum performance requirements. All pipe threads shall be Dryseal American (National) Standard Taper Pipe Threads (N.P.T.F.). This becomes mandatory within six months after the Hydraulic Standards for Industrial Equipment have been authorized for publication as approved Standards.

Agreement was reached regarding the definition of pressures. The following recommendation was made: low, 0 to and including 200 psi; medium, above 200 to and including 500 psi; medium high, above 500 to and including 1200 psi; high, above 1200 to and including 3000 psi; extra high, above 3000 psi.

Attached tables of recommended practices for both fittings and tubing are at the end of the Standards.

Definite recommendations are made regarding tubing OD sizes and increments, material of tubing, physical condition of all tubing, replaceability and support of tubing, manifolding and external drain connections. Recommendations for flexible hose in systems operating above 150 psi and the use and installation of both flexible plastic tubing and flexible hose below 150 psi are made.

Finally, recommendations are made regarding the identification of piping runs, their adequate protection and the use of built-in checking stations.

Oil Reservoirs

Section H5 treats oil reservoirs and heat exchangers in two groups of recommendations. Reservoir recommendations include: adequate provisions for sealing reservoirs against entrance of any foreign matter; a screened, removable filler hole; a breather hole protected by an air cleaner; a fluid level indicator and a well protected, accessible means for emptying the reservoir without spillage. The capacity of the reservoir is defined in terms of a reasonable height of fluid level during operation of the cycle, capacity to contain all fluid that drains back from the system by gravity, adequate heat dissipation generated by normal operation and capacity to allow air and foreign matter to separate out of the fluid.

Recommendations on heat exchangers provide for the specification by the purchaser, the use of automatic thermal controls, the service accessibility including arrangements for checking inlet and outlet temperatures of the fluid (with circulating type exchangers), provision for preventing excessive pressures in the event the exchanger becomes clogged and compatibility of both the exchanger media and materials with the system's hydraulic fluid.

Valves, Accessories and Devices

Valves, accessories and devices are the subjects of the H6 section. There are recommendations on the mounting of valves, with special attention to gasket mounted valves, valve operation to avoid detrimental surges,

provide accessibility to wires and seals after final adjustment and locking and on the means to prevent rapid drop when hydraulic power is shut-off.

Accumulators are given a position listing in this section but no recommendations regarding their design or use have been included.

Cylinders and pistons are treated rather briefly with recommendations on finishing, alignment with work slides and accessibility of external sealing devices being given. It is recommended that cylinders shall be separate, not cast integral with equipment, and be accessible for maintenance. Other suggestions cover protection of piston rods, the locking of pistons assembled to rods, the use of cushions and the design and use of cylinders to avoid entrapment of air and to prevent the gland or rod end from being subject to high pressure.

Also in section H6 are a group of standards for filters. Filters, or any means to continuously remove any materials from the hydraulic fluid that would be detrimental to the operation of the equipment, shall be provided. Such a means shall be designed to be removable without disturbing the piping and be provided with a means to indicate when the filter should be cleaned. If the filter is of a design that will remove anti-foam agents or other additives, the type and design of filter shall be agreed upon between the supplier and purchaser. Self-cleaning filters shall be automatically actuated. Suction strainers, that can be removed without draining the reservoir, shall be provided. These shall be of at least twice the intake capacity. Bypass filters must be of sufficient capacity to filter the equivalent of all the hydraulic fluid in the system within a period of eight hours.

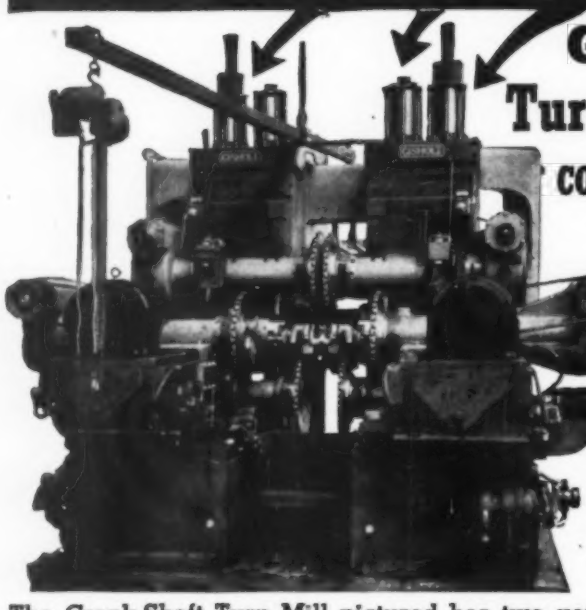
Safety

A final short section, H7, makes three recommendations on safety. First, manual controls shall be placed so that the operator is not required to reach past any revolving or turning tool, machine or equipment element; second, in systems incorporating accumulators, interlocks shall be provided to vent or isolate accumulator pressure when power is shut-off; third, flexible lines, whose failure might constitute a hazard to personnel, shall be restrained or confined.

The Hydraulic Standards for Industrial Equipment is still far from complete. However, most changes and additions will be largely of an interpretative or detailed specification nature. It was agreed and noted at the end of the Standards that no changes can be made except by mutual consent of the joint industry conference groups.

All members of the cooperating groups have or will shortly have copies of the Standards for distribution. Ask your supplier for your copy.

LAW of GRAVITY Suspended . . .



GISHOLT Turn Mill Slides COUNTER-BALANCED by NOPAK AIR CYLINDERS

GISHOLT Model TMP-6 Crank-Shaft Turn Mill equipped with four 10" NOPAK Air Cylinders which suspend heavy cutter-slides in a column of air.

The Crank-Shaft Turn Mill pictured has two vertical columns, each of which carries 2 cutter slides, one upper, and one lower.

Each slide weighs about 550 pounds and has its own counter-balancing 10" NOPAK Air Cylinder located at the top of the vertical column. There is a constant and continuous air pressure on these cylinders, and no valves of any kind are used. As these slides are counter-balanced by air, they have no gravitational weight. Their feed-movement is controlled by hydraulic cylinders.

This unique application is one of several which Gisholt has found for NOPAK Cylinders or Valves in building its line of Machine Tools. You can use them to advantage in your product . . . or in your plant.

GALLAND-HENNING MFG. CO., 2743 South 31st St., Milwaukee 7, Wisconsin

WRITE FOR NOPAK APPLICATION MANUAL

REPRESENTATIVES IN PRINCIPAL CITIES

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DESIGNED for AIR and HYDRAULIC SERVICE

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BRENNER INDUSTRIAL SALES Youngstown 5, Ohio
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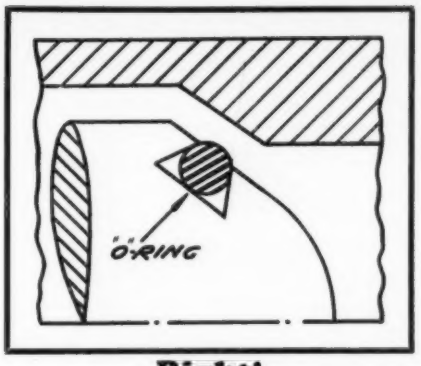
JOHN HENRY FOSTER CO. St. Louis 18, Mo.
TRANSMISSION ENGINEERING CO. San Francisco 5, Calif.

Fig. 4



Right!

By
TOMMY J. McCUISTION

The correct use of "O" RINGS ON VALVE SEATS

A PROPERLY DESIGNED check or poppet type valve, with an "O"-ring on the seat, will give exceptionally long, non-leaking service. However, many designers and engineers are making the costly mistake of trying to use a conventional groove (square or rectangular) design to hold the "O"-ring.

Wrong!

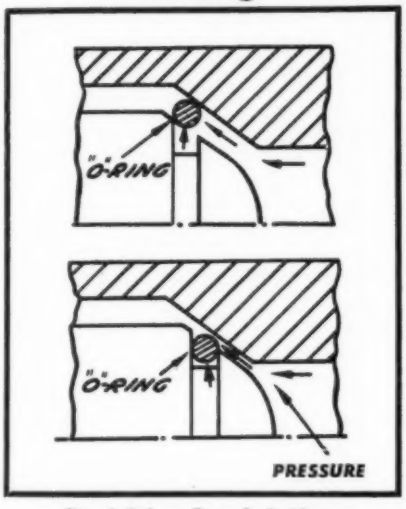
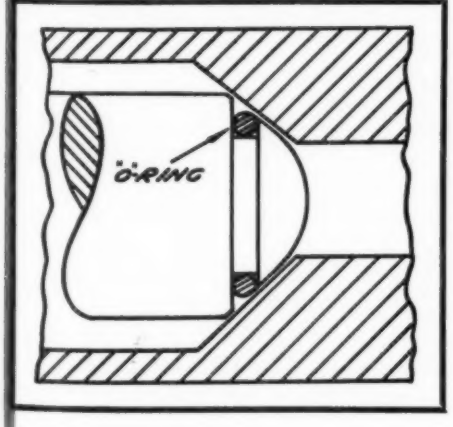


Fig. 1 Below; Figs. 2, 3 Above



With this type of groove, "blow-out" will normally occur when the valve is unseated.

"Blow-ou " is a seal failure caused by the action of the pressure in the system on the side of the "O"-ring, forcing it out of the groove into some other part of the valve or system. Blow-out usually occurs at differential pressures below 100 psi. The exact pressure will depend upon the valve design and the physical properties of the "O"-ring when a non-retaining or conventional type groove is used.

It should be kept in mind that blow-out is similar to extrusion, but that it occurs at considerably lower pressures. Figure 1 shows an "O"-ring on the seat of a check valve in a conventional groove. The seal is satisfactory as long as the valve is not opened at or near the pressure necessary to cause blow-out.

Figures 2 and 3 illustrate progressive positions of a valve opening above blow-out pressure. As the valve opens the space between the two faces becomes increasingly larger. The pressure opening the valve is also acting upon the "O"-ring, causing it to continue to seal the opening until it is stretched completely out of the groove and is blown out or forced into another part of the system.

A retaining type groove may be used to prevent blow-out. Figure 4 shows a retaining type groove design. The opening at the valve face should be 30 to 50 percent less than the width of the "O"-ring cross section. The "O"-ring surface should protrude out of the groove .015 to .025 in to effect the proper seal. The cross sectional area of the groove is approximately 10 percent larger than the "O"-ring cross sectional area in most cases. This allows sufficient space for the "O"-ring to be swelled by various fluids or lubricants and, at the same time, still be compressed into the groove when the valve is closed.

The retaining type groove does not allow the pressure to act upon more than a small portion of the "O"-ring surface. Consequently, as the valve is opened, the seal will be pulled by the groove and forced by the pressure away from the opposing face instead of continuing to seal.

The most common methods of making retaining type grooves for any except very low pressure systems are: (1) undercut the groove sides in the machining operations; however, this is usually limited to seal sizes above ½ in OD; (2) making multiple piece units so that on assembly the "O"-rings are contained.

Where a non-leaking valve is required and the cost of a rotary type groove can be tolerated, "O"-rings on valve seats make a very practical method of obtaining a satisfactory seal.

ELECTRONICS NEED NOT SCARE YOU

(Continued from page 15)

illumination and the required sensitivity.

With the circuit connections shown, the phototube will conduct the alternate half cycles during which its anode is positive, the magnitude of the current being governed by the illumination. Further, the voltage drop across R_4 appears at the grid of the thyratron.

In the circuit, Figure 4, the following static conditions obtain:

(1) Positive *potential* is applied to the top of the resistor network, the anode of the phototube and the anode of the thyratron on alternate half cycles. The thyratron heater is energized by transformer T_1 which might also be used to supply the lamp used to illuminate the phototube

(2) The grid of the thyratron is negative with respect to its cathode in an amount determined by the setting of the potentiometer during the same half cycles

(3) Positive voltage opposes the negative voltage at the thyratron grid if the phototube is conducting, i.e., it is being illuminated. In practice, the potentiometer is adjusted so that the negative voltage (termed grid bias) is sufficient to prevent the thyratron from firing when the illumination on the phototube is below a given level.

Note that if the illumination at this low level is zero, there is no opposing positive voltage at the grid. With the circuit so adjusted, should the illumination increase above such a minimum value, the voltage drop across R_4 overrides the grid bias and the thyratron conducts, energizing the direct current electromagnetic relay S_1. The resistance of the relay is such that the total impedance of the anode circuit limits the thyratron and relay currents to a value within the design ratings.

The capacitor, C_1, is used to prevent relay buzz by storing energy during the half cycles the thyratron is conducting and releasing it to the relay during the negative half cycles.

Inverse Acting Relay Circuit

By reconnecting the components of Figure 4, as shown in Figure 5, the action becomes such that a decrease in light energizes the electromagnetic relay. (The actual value of the resistors would be different from Figure 4). By virtue of the circuit connections, the grid of the thyratron becomes more positive as the current through the phototube decreases due to a decrease in illumination. The point at which the thyratron fires is controlled by the potentiometer, which is adjusted so that the contacts close when the illumination falls below a definite value.

Applications

Since the circuits described are supplied by alternating current they are operative only on the alternate half cycles when the phototube and thyratron anodes are positive. If the supply line is sixty cycle, the circuits are dead for 1/120 seconds or half of each cycle. Unless the operating periods (also 1/120 seconds) were synchronized with the line, the incidence or interruption of the light on the phototube should be at least 1/60 seconds duration.

Among the commoner uses for ac operated photoelectric relays are counting, e.g., objects on a conveyor or people passing through a gate or doorway; safeguarding presses or similar machinery; opening doors; smoke detection; operation of solenoid valves; and flame failure detection in boilers. When the primary object is counting or sounding a warning, the contacts on the small relay energized by the thyratron are usually large enough to handle the local circuit. If, however, large currents for the operation of solenoids and similar equipment are to be controlled, the small relay is used to key a larger contactor.

Summary

The ac operated photoelectric relays are intended for applications where maximum speed of response is not required, where the change in illumination is considerable and when the required control is of an "on-off" nature.

The relays cannot be operated on direct current for once the thyratron is fired it would remain conducting. A secondary control circuit to extinguish the thyratron would be awkward.

The next article will cover the operation of phototubes in connection with pliotrons, using a direct current anode supply to provide both rapid response and an output proportional to the input. This will serve as an introduction to motor control systems.

BETTER MAINTENANCE

(Continued from page 12)

any machine is down or when it is rebuilt, a skilled man is assisted by a less experienced man. The less experienced man does as much of the actual work as he can, so that a maximum of training is obtained.

The hydraulic machine program is not complete. Changes in production techniques and in equipment are constant and this means that the maintenance program must be kept flexible enough to meet and solve new problems as they come up. The goal we have set is to search for and provide some of the means for increasing overall plant and departmental efficiency. To date, progress has been made by increasing accessibility, by keeping complete operating and maintenance records, by taking the guesswork out of oil handling and conditioning and by integrating job training.

THE OILGEAR COMPANY

BROACHING MACHINES

The Oilgear Company, pioneer builder of hydraulic broaching machines, offers a standard line of fluid power, variable speed broaching machines of both horizontal and vertical types. These data sheets have been compiled with the assistance and through the courtesy of this manufacturer as an aid in the servicing and maintenance of these machines.

HORIZONTAL, Single Ram (Type XL)

General: Universal. high speed, pull type for internal and external broaching. Nine sizes, 3 to 50 tons pull, 36 to 72 in stroke. Variable cutting speeds up to 37 feet per minute and variable return speeds up to 120 fpm.

Specifications: See page 12 in Bulletin 20000-B.

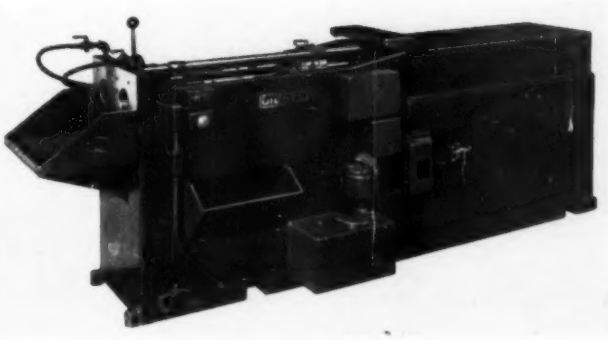
Hydraulic Circuit: One double acting cylinder with direct ram actuated crosshead and tool. Regenerative, differential return. Two-way variable delivery pump with electric remote control.

Attachments: Manual, electric, oil or air operated tool support troughs and fixtures.

Operation, Service and Parts Manual: Instruction Bulletin 920000-A.

Oil Recommendations: Bulletin 90000-E.

HORIZONTAL, Double Ram (Type XB)



General: Alternating, pull type for internal and external broaching. One size, 6 ton, 36 in stroke, variable cutting speeds up to 30 fpm with each ram speed independently adjustable.

Specifications: See page 5 in Bulletin 21000.

Hydraulic Circuit: Two double acting cylinders with direct ram actuated crossheads and tools. Two-way variable delivery pump with electric remote control.

Attachments: Manual operated tool support trough and fixtures.

Operation, Service and Parts Manual: Instruction Bulletin 921000.

Oil Recommendations: Bulletin 90000-E.

BROACHING MACHINES

VERTICAL, Cyclematic (Type XM)

General: Work pull-up type for high speed multiple internal broaching. Automatic tool handling, work centralizing and work ejection. Floor type mounting with low loading level. Three sizes, 15 to 37½ tons pull, 54 in to 66 in stroke. Variable cutting speeds up to 30 fpm.

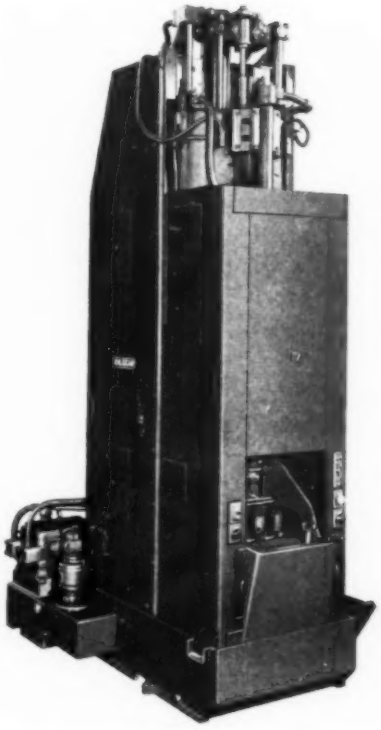
Specifications: See page 10 in bulletin 22001.

Hydraulic Circuit: One double acting cylinder with direct ram actuated vertical work table slide pulls work over stationary tools. Another double acting cylinder with direct ram actuated tool handling slide automatically lowers and raises the tools before and after the broaching operation. Regenerative, differential return. Two-way variable delivery pump with electric remote control.

Attachments: Tool holders, pullers, automatic work unloading plate and chute, full automatic control, control interlock with fixture.

Operation, Service and Parts Manual: Only tentative blueprinted instructions have been published.

Oil Recommendations: Bulletin 90000-E.



VERTICAL, Pull-Down (Type XP)

General: Tool pull-down type for high speed multiple internal and limited external broaching. Automatic tool handling and work centralizing. Ten sizes, 5 to 37½ tons pull, 30 in. to 66 in. stroke. Variable cutting speeds up to 30 fpm. and variable return speeds up to 80 fpm.

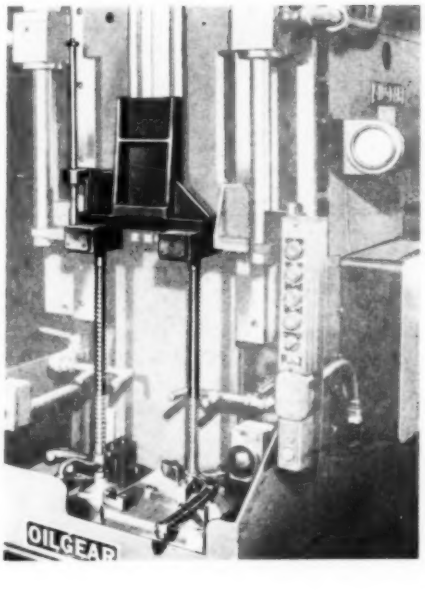
Specifications: See page 20 in Bulletin 25000.

Hydraulic Circuit: One double acting cylinder with direct ram actuated slide pulls tools downward through the work. Two other double acting cylinders with direct ram actuated tool handling slide, lower and raise the tools for loading purposes. Regenerative, differential return. Two-way variable delivery pump with electric remote control.

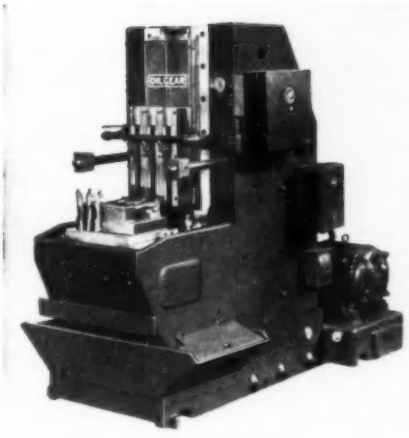
Attachments: Tool holders, pullers, reducing bushings, semi-automatic or full automatic control, control interlock with fixture.

Operation, Service and Parts Manual: Instruction Bulletin 925000.

Oil Recommendations: Bulletin 90000-E.



BROACHING MACHINES



VERTICAL, Surface, Single Slide (Type XS)

General: Tool pull-down type with automatic shuttle table for high speed external broaching. Eleven sizes, 3 to 25 tons pull, 30 to 66 in stroke. Variable cutting speeds up to 37½ fpm and variable return speeds up to 80 fpm.

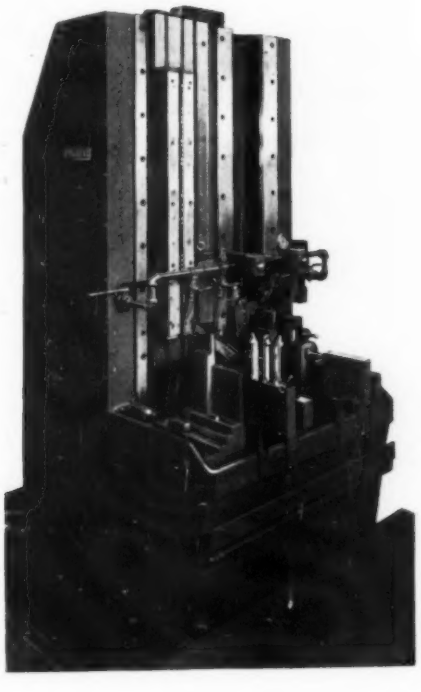
Specifications: See page 8 in Bulletin 23001-A.

Hydraulic Circuit: One double acting cylinder with direct ram actuated slide pulls tools past work. Two single acting cylinders actuate shuttle table through a single crank. Regenerative, differential return. Two-way variable delivery pump with electric remote control.

Attachments: Tools and fixtures, control interlock with fixture.

Operation, Service and Parts Manual: Instruction Bulletin 923000.

Oil Recommendations: Bulletin 90000-E.



VERTICAL, Surface, Double Slide (Type XD)

General: Alternating, tool pull-down type with automatic shuttle tables for high speed external broaching. Eleven sizes, 3 to 25 tons pull, 30 to 66 in stroke. Variable cutting speeds up to 37½ fpm with each tool slide speed independently adjustable.

Specifications: See page 8 in Bulletin 24001-A.

Hydraulic Circuit: Two double acting cylinders with direct ram actuated slides pull tools past work. Two single acting cylinders actuate the shuttle tables simultaneously through two cranks. Two-way variable delivery pump with electric remote control.

Attachments: Tools and fixtures, control interlocked with fixtures.

Operation, Service and Parts Manual: Instruction Bulletin 924000.

Oil Recommendations: Bulletin 90000-E.

Available Bulletins are of two types: (1) General Bulletins, which contain design details and features, application data, specifications and dimensional drawings; and (2) Instructional Bulletins, which contain installation, operation and maintenance information. Instruction Bulletins also contain identification illustrations of all machine elements and a part number and name list.

Catalogs or General Bulletins are furnished gratis. This is also true of Instruction Bulletins or Manuals. For copies write the Oilgear Company direct.

All Oilgear machines and attachments are protected by issued and pending United States and foreign patents.

SAVE THIS VALUABLE REFERENCE MATERIAL: BUILD UP A PERMANENT FILE

New PRODUCTS

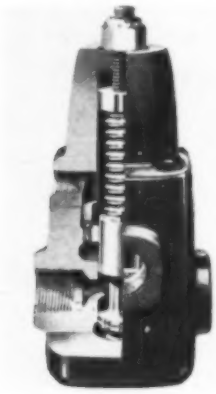
For additional information on any of these products, mark the end key numbers on the card bound in this issue and mail the card.

Nylon-Base Diaphragm Sheet

United States Rubber Co. has announced diaphragm sheet made of nylon fabric impregnated with rubber, which possesses improved sensitivity, high bursting strength, greater flexibility and light weight. Sheets are available 36 in wide in thicknesses of 1/32, 1/16, ⅛, 3/16 and ¼ in. Use Business Reply Card, mark NP-1.

Hydraulic Relief Valve

A new hydraulic relief valve that gives chatter-free performance has been developed by Gerotor May Corporation. Its



function is the protection of hydraulic systems against damaging overloads of pressure. Pressure ports permit an in-line piping arrangement; two sizes of valve springs for services in 50-300 and 50-1500 psi ranges; a spring guide, available with "O" ring seal; a one-diameter bore for accurate plunger fitting; and a self-sealing locknut which eliminates lost valve caps are features of the new valve. Use Business Reply Card, mark NP-2.

Pneumatic Control Valves

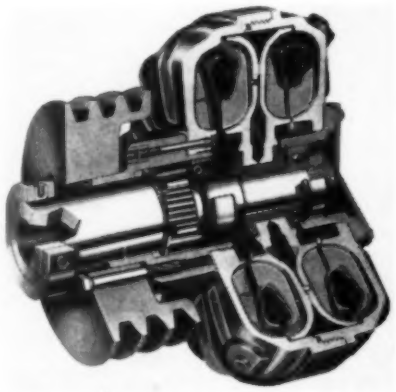
Numatics, air equipment manufacturer, announces 3-way valve control units for installation on pneumatic cylinders. Close or remote location positions are possible, the design permitting manual throttling at individual exhausts. The valves are available in sizes ½, ¾ and 1 in. Use Business Reply Card, mark NP-3.

Limit Switch

The Square D Company now has available their machine tool limit switch, which has been very popular in single unit design, in duplex mounting. The principal advantage of the duplex switch is in the simplification and reduction of conduit runs and wiring. The switch units may be mounted with both operating ends together or with one unit reversed in respect to the other. Operating arms with plain or one way rollers are available as well as pushrod operated switch units. Use Business Reply Card, mark NP-4.

Hydro-Sheave Drive

The Twin-Disc Clutch Company announces a new hydraulic power transmission unit—the Hydro-Sheave Drive. The drive is a hydraulic conversion



device for small electrical motors and internal combustion engines. Built around a Twin Disc small hydraulic coupling, the drive package consists of the coupling, and a sleeved shaft which slides directly over the output shaft of any small motor or engine. The Hydro-Sheave drive is easily assembled to any small power unit. The drive models will be packaged in five sizes, one single circuit and four double circuit units. Designed especially for Worthington QD V-belt sheaves; however, a chain sprocket of the plate type can be used with some alterations. Use the Business Reply Card, mark NP-5.

Oil Clarifier

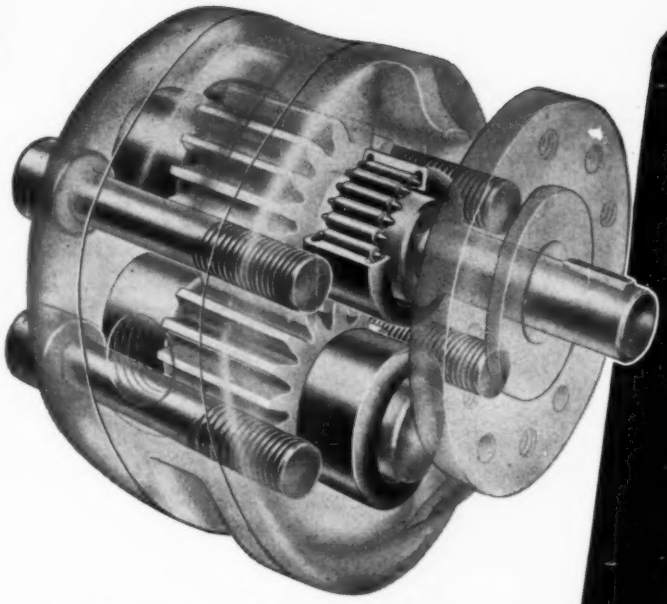
W.G.B. Oil Clarifier, Inc., has marketed a multiple purpose filter, stated to be equally efficient for lube or fuel oil clarification or for cutting oils. The

unit employs a replaceable filter cartridge, which can be replaced without tools. The outside-to-inside filter has a filtering area of 272 sq in when used for lube oil and 238 sq in when fuel cartridges are used. Use Business Reply Card, mark NP-6.

Hose Clamps

Self-tightening, spring steel hose clamps for use wherever rubber or fabric hose must be connected to metal tubing to carry air, gas or liquids, is announced by Corbin Screw Division, American Hardware Corporation. In one piece, rounded stock and made of cadmium-plated, heat treated steel, the clamps are available in sizes to fit ODs from 7/16 to 2⅝ in. Use Business Reply Card, mark NP-7.

(Continued on page 26)



Announcing THE HYDRECO Four Bolt

HIGH PRESSURE OIL HYDRAULIC GEAR PUMP

A NEW PUMP FOR TOUGH SERVICE

•

FIVE BASIC SIZES
2.5 G.P.M. to 130 G.P.M.

Improved Design... Location of the assembly screws within the high pressure area reduces distortion and

Long Life..... wear of pump covers and internal parts and allows use of larger roller bearings.

Efficiency..... With internal distortion and wear reduced and larger bearings installed, close internal clearances and high pump efficiency are maintained longer.

Simplicity..... Fewer parts and held to closer tolerances.

REDUCE YOUR COSTS
NATIONAL MATERIALS HANDLING SHOW
PHILADELPHIA JAN 10-14 1949
VISIT OUR EXHIBIT

Write for Catalog and Complete Information

PUMPS • CYLINDERS • VALVES

HYDRAULIC EQUIPMENT COMPANY 1104 EAST 222nd STREET • CLEVELAND 17, OHIO

NEW PRODUCTS

(Continued from page 24)

AC Solenoid

Three models of continuous duty solenoids, designed for high speed and quiet operation, for valves and machine control applications are available from Detroit Coil Co. Units are available in both push and pull types. Use Business Reply Card, mark NP-8.

Four-Way Solenoid Valve

A new 4-way solenoid valve is announced by Hanna Engineering Corp. The small, compact unit, of the balanced spool type, is controlled by a built-in solenoid pilot valve. A practical manifold design permits flexibility in piping arrangement; the valve is adaptable to straight line piping, with valve capacity equal to rated pipe

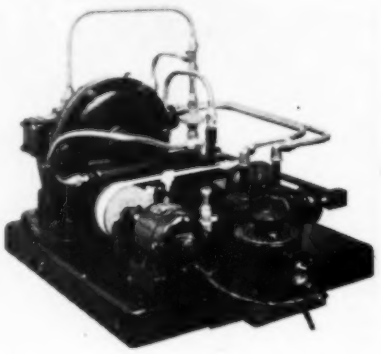
size. Valves and manifolds are interchangeable and the valve may be removed from manifold without disconnecting pipe lines. The new solenoid valve is fast acting, mechanically silent, with a 5/32 in solenoid stroke and low current consumption. Use Business Reply Card, mark NP-9.

Air Line Joint

A new universal Air-Line-Joint, vibration-proof and designed to swivel 360 degrees, has been announced by Universal Air-Line-Joint Mfg. Co. Designed originally for die sinking machines, the new joint has many applications wherever compressed air is used or where liquid cooling piping is required. Use Business Reply Card, mark NP-10.

Edge Positioner

A new edge positioner which controls the position of any sheet-like material entering a process over rollers within limits of plus or minus .05 in by simple mechanical means, is



announced by Askania Regulator Company. Standard Askania control components with the addition of a pair of air nozzles does the job. Any process in which coating, coiling or an endless belt conveyor is used can be improved by the positioner which controls the position of the sheet on the roller. Air nozzle positions are adjustable for changing the position of the sheet in relation to the center of the roll. The sheet will follow the air nozzles until the proper controlling impulse is received by the diaphragm of the pressure regulator. Use Business Reply Card, mark NP-11.

Tube Cutter

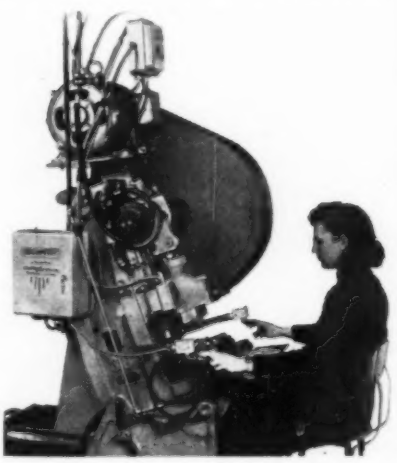
A new tube cutter with "free wheeling" ball bearing action has been announced by The Imperial Brass Mfg. Co. Ball thrust bearings built into the tool provide extremely easy operation and make speedy size adjustment possible. A patented flare cut-off groove in the rollers makes it possible to remove a cracked flare without waste of tubing. The cutter is designed to use with copper, brass, aluminum, Bundy steel, block tin and lead tubing and will cut all sizes from ⅛ to 1 in OD. Bulletin No. 367 gives full details. Use Business Reply Card, mark NP-12.

REPRESENTATIVES AVAILABLE

Wanted to represent hydraulic units, standards and specials complete with full line of hydraulic valves and pumps, by aggressive experienced engineering sales office covering northeastern Ohio who have close association with potential users; our present connection is too limited. Major requirements 1000 p.s.i. Write Box 12481.

Tripping Control

Micro Switch announces a new two-hand, easy-to-operate electrical device for the safe control of tripping mechanisms on air presses, punch presses, shears, riveting machines and spot welders. Light touch actuation, from 10 to 18 ounces, reduces operator fatigue and in many cases results in 10 to 25 percent increase in production.



The Microtrip consists of a control box, two Micro precision switches and the necessary tripping mechanism. It is easily and quickly installed on present equipment. Use Business Reply Card, mark NP-13.

Valve Refacer

The Independent Pneumatic Tool Co. is offering a new model "99" valve refacer, a streamlined basic model designed for precision wet grinding. Equipped with a double-grip collet and new speed chuck, all standard angles can be refaced. The chuck permits large butt-end valves to be admitted and released with only one turn of the new 2¼ in hand wheel. Use Business Reply Card, mark NP-14.

Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

25. Hydraulic Packings . . . Mabbs Hydraulic Packing Co., in a 2-page circular, describe the rawhide packings that they produce. They are recommended for use on shafts, plungers, rods, valve stems and for other similar operations. The packings are available in sizes from 1/16 to 2 in for pressures to 10,000 psi.

26. Chemical Additives . . . American Cyanamid Company has available a 20-page booklet entitled "Chemical Additives for Petroleum Lubricants." This booklet explains in nontechnical language what additives are, why they are needed, when and where they are used and how they improve oils. A number of simple illustrations are included to assist the reader in understanding the action of each. This booklet covers all of the commonly used types of additives.

27. Air Operated Devices . . . Mead Specialties Company review the air powered industrial equipment they manufacture in their general catalog. Air cylinders and air operated devices are included. The cylinders are offered with strokes to 3 in and bores to 5 in in a variety of mountings and special set-ups. The air operated devices include presses, vises, collet fixtures, filters, work feeders and hand, quick exhaust and speed control valves. Illustrations used throughout show design features and typical installations.

28. Hydraulic Pumps . . . Bulletin 238 describes the duplex hydraulic pressure pumps produced by Warren Steam Pump Company, Inc. These pumps are of the forged barrel type and come completely equipped at both steam and liquid ends. Operating pressures, liquid ends, are up to 10,000 psi; operating pressures as steam ends are 250 lb gage max. These pumps are designed for long life with minimum maintenance under the heaviest and most exacting work. The last page of this bulletin contains a complete specifications chart.

29. Control Catalog . . . A condensed control catalog, GEA-642, devoted to ac and dc motor control and accessories has been published by General Electric. This catalog presents the types of controls that are of most general interest. Motor starters, push buttons, limit switches, solenoids, photoelectric relays and other devices are included. In addition two pages are devoted to factors to be considered in selection of controls. Photographs are used to illustrate each type of control and mention is also made of the other types of controls offered by this manufacturer.

30. Air Controls . . . The industrial air controls produced by Bendix-Westinghouse Automotive Air Brake Company are reviewed pictorially in a small bulletin released recently. Robotair chamber and rotochamber units are described with selection charts included for determining unit sizes for specific uses. Also included are quick release, pressure reducing, relay and two-and three-way valves in addition to filters and gauges.

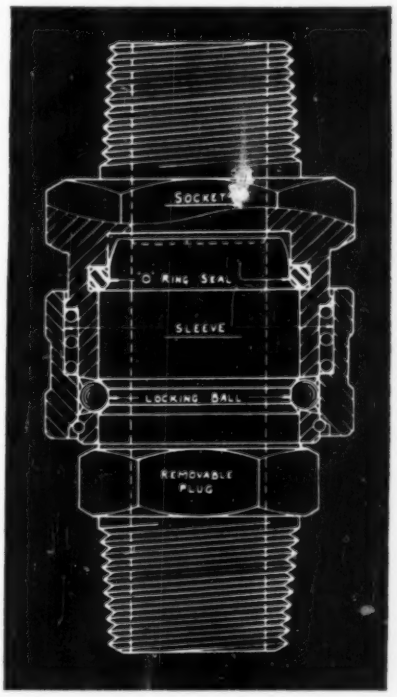
31. Quick Couplings . . . Catalog No. R-100, describing the couplings, caps, coupling-valves and related products produced by Roylyn, Incorporated, is now available for distribution. Of special interest is the quick coupling that employs only

(Continued on page 28)

USE "O" RING SEALS

(The modern packing method)

FOR SIMPLICITY • RELIABILITY
LOW COSTS • SPACE SAVINGS



"O" Ring Seals made possible this simple, straight through, quick disconnect coupling by THE HANSEN MANUFACTURING COMPANY of Cleveland, Ohio.

The end of the removable plug is tightly sealed by the "O" Ring when the plug and socket are in the locked position. Yet the plug can be removed and re-connected thousands of times without leakage.

Think of how complicated, bulky and costly this coupling would have been had conventional packings been used.

You, too, may have a problem that can easily be solved by using simple "O" Ring designs. For complete Engineering Data write for our "O" RING HANDBOOK.

PLASTIC and RUBBER
Products, Inc.
Dept 1, Oakridge Drive, Dayton 1, Ohio

USEFUL LITERATURE

(Continued from preceding page)

three major parts: a cam ring, a ball cage and a nipple. It is available in aluminum, steel and brass for operating pressures to 11,000 psi. Also included are open, instrument line and self-sealing couplings, hose assemblies and strainers. Design drawings and photographs are used throughout.

32. Packing Handbook . . . Goodall Rubber Company, Incorporated, has prepared a handbook, now available, on hydraulic packings and seals. V-rings, O-rings, U-cups and typical installations are described and reviewed in some detail with design drawings and specification charts included. V-rings and O-rings are offered in sizes from 3/16 to 16 in and U-cups in sizes to 3 in. In addition, a page at the end of each section is devoted to general and specific suggestions on each type of packing.

33. Air Servo Unit . . . Operation and design of the Micro-Servo produced by Hagan Corporation is described in literature now available from this company. The unit is a relay-operated pneumatic power unit designed for accurate, short distance positioning of valves or other mechanisms. It can be controlled by automatic or manual means from remote distance. The unit is available in several designs with fixed strokes ranging from ⅛ to ¾ in and a stalling force of 300 lb with an air supply of 60 psi.

34. Leather Packings . . . The procedure for ordering made-to-order leather packings from Horace G. Preston Company is described in a 12-page booklet available from this company. Items are not kept in stock as all production is for specialized operations. Cup, flange, "U", "V" and gasket packings are available for exposure to air, oil and water at any expected operating degree of heat.

35. Power Actuated Valves . . . The Hydro-new-matic power actuated valves manufactured by Hydraulic Company are described in a bulletin recently released. Almost any pressure supply can operate these valves including oil, air or water, for machinery controls, machine tool auxiliaries and special machinery operations where reversible variable speed power incorporating high torque at slow speeds is desired. Design drawings and photographs are included.

36. Hydraulic Packings . . . A 4-page pamphlet, available from The James Walker Packing Co., Inc., reviews the hydraulic packings of special design and composition that they produce. They are recommended for rams and plungers of heavy duty hydraulic presses, accumulators, pumps, elevators and all hydraulic work. Expanding and block type packings are available in 12 ft spiral lengths or in rings to fit rod. All sizes from ½ in up are offered.

37. Air Operated Controllers . . . The Brown Instrument Company, Division of Minneapolis-Honeywell Regulator Company, reviews their line of air operated controllers for pressure and flow applications in Catalog No. 8905. Of special interest are time-pattern controllers, pneumatic remote index systems, air motor valves, air operated motors and pressure controllers. Illustrations are used to show principles of operation, design and installation.

38. Solenoid Valves . . . Bulletin No. 270, issued by The Johnson Corporation, describes the construction, operation and application of the Johnson direct operated solenoid valve for automatic or remote flow control of liquids and steam up to 400 F of high viscosity fluids. Designed to operate under differential pressures up to 150 psi without any need for pilot valves, the normally closed valve opens instantly to full capacity. Standard valves for pipe sizes ½ to 3 in are furnished for operation on 110, 220 or 440 v 60 cycle current.

Request a list of publications on hydraulics and pneumatics as applied to industrial machinery, equipment and tools. Realize from personal search that extremely little material is available, and would, therefore, appreciate a copy of your list.

A.W.K.

A copy of the list is being sent to you.

The data sheets on hydraulic maintenance of machine tools which you started in your October issue are fine. As a maintenance supervisor, I hope you include all types of machine tools and production machines. How about doing the same for the elements of hydraulic systems? For example, we find very little maintenance material on pumps or valves.

C.T.D.

The series Hydraulic Maintenance of Machine Tools will continue indefinitely until all the major types of machine tools have been covered. Equivalent data on the individual elements of hydraulic systems is another matter. Because hydraulic structures, units and elements are auxiliary equipment for the most part and are designed and sold to perform a specific function in a machine or for a mechanism, the machine builder, logically, does not wish to divide responsibility for the operation or the maintenance of his equipment. The other reason is that hydraulic equipment is relatively new to most maintenance departments. This makes it difficult or impractical in some cases for the manufacturer of hydraulic equipment to attempt to furnish "standard" maintenance procedures.

We have been buying turbine oils from two sources. One insists that straight mineral oils should be used, the other that additives for our type of service should be used. Our service is almost continuous and we use fine mesh type filters. Unfortunately, we have not kept records carefully enough to tell any cost difference. However, we are contemplating installing a central clarifying system. Will the type of oil we use make any difference with such a system?

F.P.

Choose your oil on the integrity of a supplier and ask his advise on test and maintenance records to be kept. The service characteristics of the oil or oils you are using can be discussed with the representative of the company that makes the clarifying equipment.

The policy of our company is to be as self sufficient as possible in the servicing of all production equipment. Our sources of supply on hydraulic pumps discourage us from attempting to rebuild our pumps. Maybe they are right. However, before we give up we would like to

(Continued on page 31)

Applied HYDRAULICS DIGEST

Abstracts, summaries and listing of articles on hydraulic and associated applications in industry; reports on prepared papers, talks and discussions of special interest to the hydraulics field.

Die Cast Air Motor

Anonymous, *Die Castings,* v 6, November 1948, pp 21, 22, 58.

The details of design of a multistage, rotary piston air motor made by Berry Motors, Inc., Corinth, Miss., are given. The motor is built almost entirely of zinc alloy die castings; a series of flat die cast plates fit together face-to-face without further machining or the use of sealing compound or gaskets. The motor is very simple. Three thermodynamically balanced stages are connected by cored passages, the air driving each of three pistons in turn by means of a U-shaped channel inside the transfer chambers. The entire motor is assembled on two shafts and eight through bolts. Main shaft and abutment valve shaft are supported by anti-friction ball bearings. A Woodruff keyway cast into each piston and valve accurately times the power cycle. A steel washer is recessed into each cylinder cover plate to avoid zinc-on-zinc contact between the ends of pistons and valves and the cylinder cover plates. Die castings, by eliminating machining, have made high production, low unit cost practical for many types of applications.

The Servicing of Hydraulic Equipment

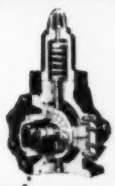
H. G. Conway, *Aircraft Engineering* (British), August 1948.

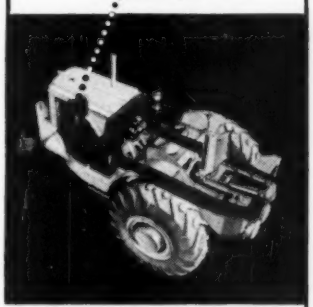
A reprint. The technical director of the British Messier Ltd., aircraft manufacturer, has compiled "comprehensive notes on the maintenance duties and problems that face the mechanic." The notes, while they apply primarily to aircraft hydraulic servicing, are exceptionally well integrated and useful to any hydraulic maintenance men. Both British and American types of hydraulic fluids and rubber are discussed. A

POWER PLUS for Hydraulic Steering

Photos courtesy The Heil Company Milwaukee, Wisc.

THE HEIL COMPANY'S big, heavy duty Heiliner, 2-wheel, high speed tractor shown above, utilizes hydraulic steering. The complete unit, consisting of tractor and scraper, when loaded weighs 45 tons. The power is supplied by a Variable Volume Special RACINE Pump, modified to provide easy handling of this giant earth mover. Note photo to right—pump is engine driven.





Variable Volume RACINE Pumps provide a source of hydraulic force with these advantages—simplified circuits—reduced number of needed valves—lower horsepower consumption. On many installations, smaller oil reservoirs may be used because heating is reduced.

Trained hydraulic engineers and a well qualified staff of special field representatives offer you a complete consulting service without cost or obligation. Write today for our catalog P-10-C, illustrating RACINE's full line of Variable Volume Pumps, Sleeve Type Valves and Pressure Boosters. Address RACINE TOOL AND MACHINE CO., 1774 State St., Racine, Wisconsin.

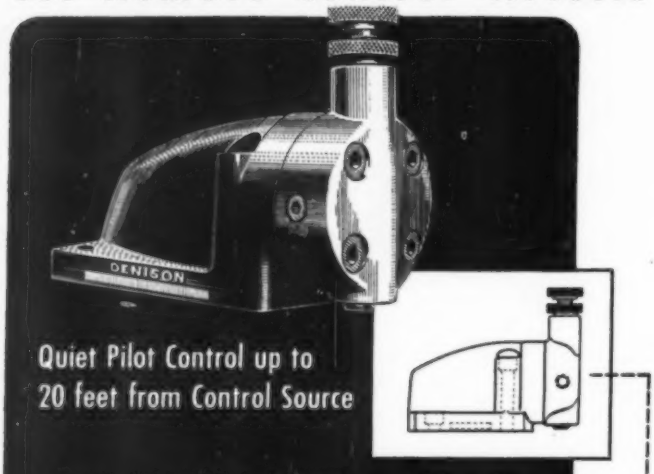
RACINE *Hydraulic* FOUR-WAY VALVES

A complete line of sleeve-type, balanced-piston four-way oil hydraulic valves in 3/8" to 1 1/2" I.P.S. are available for your hydraulic circuits. Models can be supplied for either manual, electrical or mechanical control.

RACINE

STANDARD FOR QUALITY AND PRECISION

Really Quiet
HYDRAULIC
Relief and Pilot Valves for Remote Control Circuits

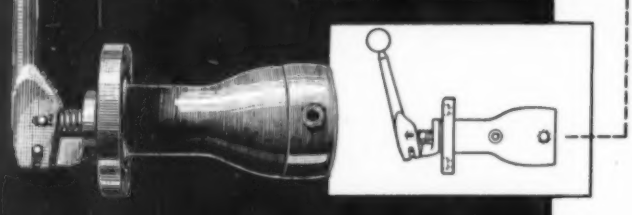


Quiet Pilot Control up to 20 feet from Control Source

YOU GET RID of the noise problem for good in remote-control hydraulic circuits when you use Denison relief and pilot valves. They're chatter-free—really QUIET—even with the control as high as *twenty feet* from the relief valve. And their quietness is matched by their accuracy. You can set up convenient remote-control panels for any number of hydraulic circuits without the annoying squeals and howls you get from ordinary hydraulic valves.

The advanced engineering of these modern, compact, *rugged* relief valves also reduces the differential between opening and closing pressures . . . brings faster action that eliminates over-pressure and pressure-drop troubles.

4 MODELS: Denison ¼" relief valves are ideal for pressure control up to 5000 psi, with volumes up to 32 gpm. Both threaded-body and subplate types are available for either foot or flange mounting. Write for full details today.



The DENISON Engineering Company
1166 Dublin Road • Columbus 16, Ohio

DENISON EQUIPMENT for APPLIED HydrOILics

good deal of attention is directed to pipe cutting, bending and installation. Both flared and non-flared fittings are given attention. Problems encountered with slide, rotary and poppet valves are detailed, with most attention being given to poppet valves. A check list of notes on servicing of components includes cylinders, accumulators, pumps, valves, test rigs and gear. Emphasis is placed on the understanding and use of line diagrams in shooting trouble.

Ford Handles by Automation

Rupert Le Grand, *American Machinist,* v 92, October 21, 1948, pp 107-122.

Automation is defined as the art of applying mechanical devices to manipulate workpieces in and out of equipment, turn parts over between operations, remove scrap and to perform these tasks in timed sequence with the production equipment so that the line can be put wholly or partially under pushbutton control at strategic stations. Manual work is largely restricted to placement of small subsidiary parts in an assembly. The Ford Motor Company set up the Automation Department in April 1947 to: operate its equipment at maximum rate to achieve planned production goals; to distribute the available labor supply over jobs that require human dexterity; and to make jobs safer. To date this department has produced approved designs for over 500 devices to cost $3,000,000. Based on the devices already in operation, it is expected that production will be increased 20 percent on the average, jobs will be safer and that approximately 1,000 men will be transferred, many upgraded.

A wide variety of devices are described and pictured; most of these are also shown in line diagrams. Included are hydraulic lifts for die and heavy piece loading, vacuum cup handlers on air cylinder actuation, hydraulic motor drives for leadscrews to coordinate stock handling with press movement, air and hydraulic turnover devices and air operated "iron hands". The use of iron hands, especially for horizontal movement handling has been a feature of this development.

Rust Prevention of Equipment in Storage and Use. Lead Article, *Lubrication,* the technical house organ of The Texas Company, v 34, October 1948.

The characteristics of rust preventive materials, procedures for preserving equipment, cleaning, drying, application of rust preventive and methods of testing rust preventive materials are discussed from the practical man's point of view. The problem of preparing any equipment for shipment, packaging and indefinite storage is discussed from the angle of the experienced lubrication man. The procedure recommended for protecting hydraulic elements is outlined. The common procedures for applying rust preventives are given.

(Continued from page 28)

talk to one or two companies that do this type of work.

B.C.T.

There is an article in this issue by K. W. Zintz of The Hoover Company, North Canton, Ohio, on their maintenance work which includes the rebuilding of pumps.

We like the plan you used in setting up the description of the functioning of a circuit separately with the circuit diagram as you did in "Increasing Laundry Profits" in the September issue. It makes the circuit easier to understand and follow. I hope you make this a regular practice.

B.J.

The editors always like to know how various treatments of material appeal or don't to our readers. The treatment mentioned which we like to call a "two-stage" story, is also used in "Straight Line Indexing" in the November issue. We like it ourselves since it permits attention to be focused on the circuit and diagram without frequent cross references to the general narrative of the story. It is convenient for those of our readers who are keeping a clip file of circuit diagrams. We will continue this type of treatment whenever it is practical.

This column is open to comments on general trade and technical problems. Comments are invited from our readers on questions or answers as published—EDITOR.

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

The Lyon-Raymond Corporation will exhibit new and improved models of their hydraulic sheet feeding tables at the Third National Materials Handling Show to be held in Philadelphia, January 10-14.

MacMillin Engineering Corporation announces the opening of their new, enlarged offices at 6806 North Clark St., Chicago.

Sun Oil Co., Philadelphia, has appointed Marcus A. Markley as manager of its industrial products department. Mr. Markley had been Industrial Products Division manager of the New York division. James E. Stine, Jr., succeeds Mr. Markley in the New York office.

The Meletron Corporation, Los Angeles, Calif., announces the appointment of the B. W. Rogers Company, 850 S. High St., Akron, Ohio, as their exclusive representative for the state of Ohio.

Union Iron Works, Erie, Pa., manufacturers of heat exchangers and other products has appointed Chemical Pump & Equipment Corp., New York, as representative for eastern New York state and western Connecticut.

Allen-Bradley Co., Milwaukee, has moved its northern Ohio office to new quarters at 4312 Carnegie Ave., Cleveland. R. J. Roy is district manager.

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Viking Products Co., Inc., Detroit, Mich., recently organized to manufacture automatic air valves, has completed the tooling and installation of equipment at its Vicksburg, Mich. plant, where solenoid operated air valves will be produced.

Hydraulic Press Mfg. Co. has moved its New York office to 500 Fifth Ave., New York.

The Farm Bureau Equipment Institute announces the election of P. H. Noland as president of the Institute. Mr. Noland is president of B. F. Avery & Sons Co., Louisville. Mr. Theodore Johnson, president, J. I. Case Co., was elected chairman of the executive committee, and P. H. Kroll, president, Gleaner Harvester Co., was elected a member of the executive committee at the same time.

The E. F. Houghton & Co. of Canada, Ltd., has begun operations in its new plant at 100 Symes Road, Toronto. Industrial oil and leathers will be manufactured.

Ajax Flexible Coupling Co. Inc., Westfield, N. Y. has appointed A. W. Nash Co., Los Angeles as its representative in southern California.

The Charles W. Snyder Company, Inc., Tulsa., has been appointed as mid-continent distributor by Kieley & Mueller, Inc., manufacturer of automatic valves, pressure and level controls.

Jack & Heintz Precision Industries, Inc., Cleveland, have opened a branch office in Los Angeles. P. R. Baus will manage the new office, located in the Hollywood Professional Bldg., Hollywood, Calif.

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Index to Advertisers

Aeroquip Corporation ..... Cover 2
Airmatic Valve, Inc. ..... Cover 3
American Crucible Products Co., The 31
Anker-Holth Mfg. Co. 2
Brown & Sharpe Mfg. Co. 1
Denison Engineering Co. 30
Double A Products Co., Inc., Hydraulic Hi-Speed Division of 7
Galland-Henning Mfg. Co. 18
Gerotor May Corporation 4
Hanna Engineering Works 5
Hydraulic Equipment Co. 25
Marvel Engineering Co. 32
Pesco Products Div., Borg-Warner Corporation 9
Plastic and Rubber Products, Inc. 27
Racine Tool & Machine Co. 29
Ross Operating Valve Co. 32
A. Schrader's Son, Division of Scovill Manufacturing Company, Incorporated 31
Sundstrand Hydraulic Division, Sundstrand Machine Tool Co. .. 6

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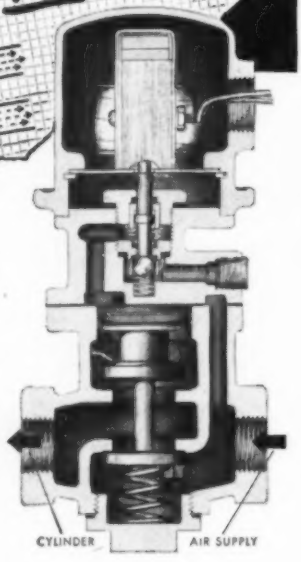

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